APPENDIX D

Vibration Assessment

199 BASSETT STREET RESIDENTIAL MIXED-USE PROJECT GROUNDBORNE VIBRATION ASSESSMENT

San José, California

August 24, 2017

Prepared for:

Fiona Phung
David J. Powers & Associates, Inc.
1871 The Alameda, Suite 200
San José, CA 95126

Prepared by:

Casey Zaglin and
Michael S. Thill

ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality
1 Willowbrook Court, Suite 120
Petaluma, CA 94954
(707) 794-0400

Job No.: 17-082

INTRODUCTION

The project site is located at 199 Bassett Street, between Terraine Street and North San Pedro Street, in downtown San José, California. The Union Pacific Railroad (UPRR) borders the site to the north. As proposed, the project would construct an 18-story residential tower with approximately 302 residential units and 10,150 square feet of ground floor retail.

This report evaluates the project's potential to result in significant vibration impacts with respect to applicable California Environmental Quality Act (CEQA) guidelines. The report is divided into three sections: 1) the Introduction; 2) the Fundamentals of Groundborne Vibration that provides a brief description of the sources and effects of environmental ground vibration; and, 3) the Analysis Section that summarizes applicable regulatory criteria, discusses the existing conditions; and evaluates vibration issues with respect to policies in the City's General Plan and other applicable guidelines, and presents measures to mitigate excessive vibration, where necessary.

FUNDAMENTALS OF GROUNDBORNE VIBRATION

Ground vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One method is the Peak Particle Velocity (PPV). The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. In this report, a PPV descriptor with units of mm/sec or in/sec is used to evaluate construction generated vibration for building damage and human complaints. Table 1 displays the reactions of people and the effects on buildings that continuous vibration levels produce.

The annoyance levels shown in Table 1 should be interpreted with care since vibration may be found to be annoying at much lower levels than those shown, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying. Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors, or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage.

Construction activities can cause vibration that varies in intensity depending on several factors. The use of pile driving and vibratory compaction equipment typically generates the highest construction related groundborne vibration levels. Because of the impulsive nature of such activities, the use of the PPV descriptor has been routinely used to measure and assess groundborne vibration and almost exclusively to assess the potential of vibration to induce structural damage and the degree of annoyance for humans.

The two primary concerns with construction-induced vibration, the potential to damage a structure and the potential to interfere with the enjoyment of life, are evaluated against different vibration limits. Studies have shown that the threshold of perception for average persons is in the range of 0.008 to 0.012 in/sec PPV. Human perception to vibration varies with the individual and is a function of physical setting and the type of vibration. Persons exposed to elevated ambient vibration levels, such as people in an urban environment, may tolerate a higher vibration level.

Structural damage can be classified as cosmetic only, such as minor cracking of building elements, or may threaten the integrity of the building. Safe vibration limits that can be applied to assess the potential for damaging a structure vary by researcher and there is no general consensus as to what amount of vibration may pose a threat for structural damage to the building. Construction-induced vibration that can be detrimental to the building is very rare and has only been observed in instances where the structure is at a high state of disrepair and the construction activity occurs immediately adjacent to the structure.

Railroad and light-rail operations are potential sources of substantial ground vibration depending on distance, the type and the speed of trains, and the type of railroad track. People's response to ground vibration has been correlated best with the velocity of the ground. The velocity of the ground is expressed on the decibel scale. The reference velocity is 1×10^{-6} in./sec. RMS, which equals 0 VdB, and 1 in./sec. equals 120 VdB. Although not a universally accepted notation, the abbreviation "VdB" is used in this document for vibration decibels to reduce the potential for confusion with sound decibels.

Typical background vibration levels in residential areas are usually 50 VdB or lower, well below the threshold of perception for most humans. Perceptible vibration levels inside residences are attributed to the operation of heating and air conditioning systems, door slams and foot traffic. Construction activities, train operations, and street traffic are some of the most common external sources of vibration that can be perceptible inside residences. Table 2 illustrates some common sources of vibration and the association to human perception or the potential for structural damage.

TABLE 1 Reaction of People and Damage to Buildings from Continuous or Frequent Intermittent Vibration Levels

Velocity Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.01	Barely perceptible	No effect
0.04	Distinctly perceptible	Vibration unlikely to cause damage of any type to any structure
0.08	Distinctly perceptible to strongly perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
0.1	Strongly perceptible	Virtually no risk of damage to normal buildings
0.3	Strongly perceptible to severe	Threshold at which there is a risk of damage to older residential dwellings such as plastered walls or ceilings
0.5	Severe - Vibrations considered unpleasant	Threshold at which there is a risk of damage to newer residential structures

Source: Transportation and Construction Vibration Guidance Manual, California Department of Transportation, September 2013.

TABLE 2 Typical Levels of Groundborne Vibration

Human/Structural Response	Velocity Level, VdB	Typical Events (50-foot setback)
Threshold, minor cosmetic damage	100	Blasting, pile driving, vibratory compaction equipment
		Heavy tracked vehicles (Bulldozers, cranes, drill rigs)
Difficulty with tasks such as reading a video or computer screen	90	
		Commuter rail, upper range
Residential annoyance, infrequent events	80	Rapid transit, upper range
Residential annoyance, occasional events		Commuter rail, typical Bus or truck over bump or on rough roads
Residential annoyance, frequent events	70	Rapid transit, typical
Approximate human threshold of perception to vibration		Buses, trucks and heavy street traffic
	60	
		Background vibration in residential settings in the absence of activity
Lower limit for equipment ultra-sensitive to vibration	50	

Source: Transit Noise and Vibration Impact Assessment, US Department of Transportation Federal Transit Administration, May 2006.

ANALYSIS

Regulatory Background – Vibration

The City of San José has established vibration guidelines applicable to this analysis.

City of San José General Plan. The Environmental Leadership Chapter in the Envision San José 2040 General Plan sets forth policies to achieve the goal of minimizing vibration impacts on people, residences, and business operations in the City of San José. The following policies are applicable to the proposed project:

EC-2.1 Near light and heavy rail lines or other sources of ground-borne vibration, minimize vibration impacts on people, residences, and businesses through the use of setbacks and/or structural design features that reduce vibration to levels at or below the guidelines of the Federal Transit Administration. Require new development within 100 feet of rail lines to demonstrate prior to project approval that vibration experienced by residents and vibration sensitive uses would not exceed these guidelines.

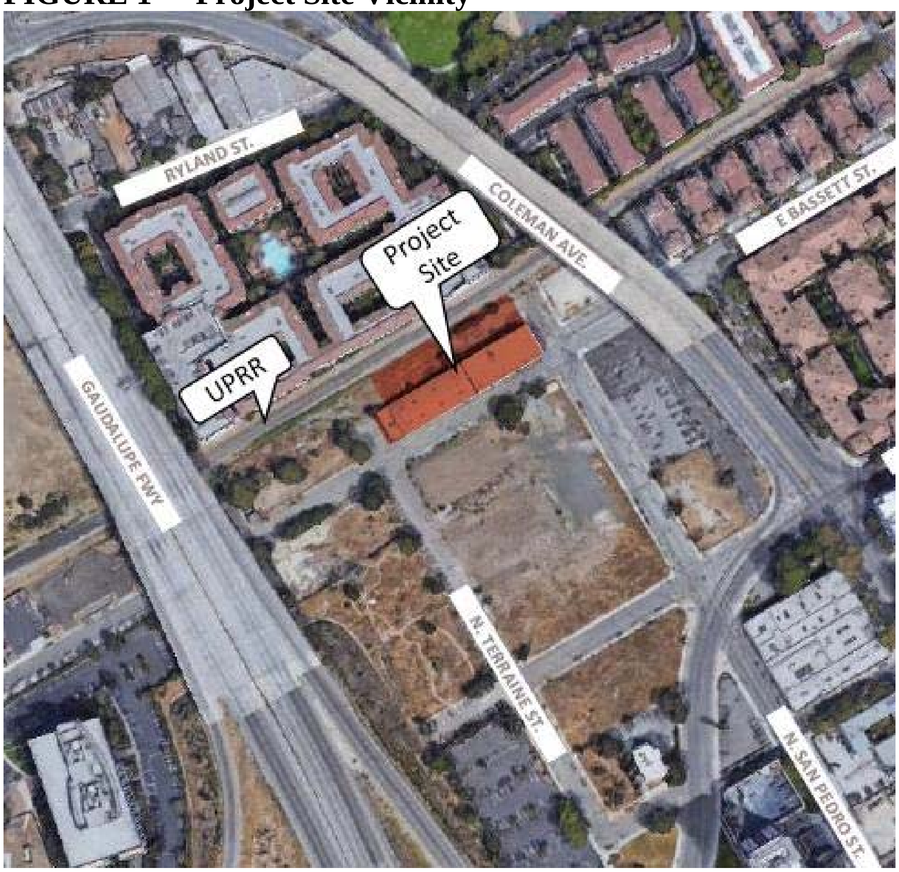
EC-2.3 Require new development to minimize vibration impacts to adjacent uses during demolition and construction. For sensitive historic structures, a vibration limit of 0.08 in/sec PPV (peak particle velocity) will be used to minimize the potential for cosmetic damage to a building. A vibration limit of 0.20 in/sec PPV will be used to minimize the potential for cosmetic damage at buildings of normal conventional construction.

Existing Conditions

The project site and vicinity are shown on Figure 1. Railroad train operations on the UPRR tracks bordering the project site on the north are the source of existing ground vibration that could potentially affect the future project. There are historically, and currently, 3 to 4 slow moving trains per day on this lightly used connecting track between Milpitas and San Jose.[1]

Existing land uses in the vicinity of the project that could be affected by vibration resulting from project related construction activities include the Fountain Plaza Apartments located north of the UPRR corridor and multi-family residential units located along Bassett Street east of Coleman Avenue. The proposed North San Pedro Studios Project, adjoining the project site to the west would be a sensitive use if constructed prior to construction of the project.

FIGURE 1 Project Site Vicinity



[1] U.S. Department of Transportation, Federal Railroad Administration, U.S. DOT Crossing Inventory Form for crossing 750136G, accessed July 6, 2017.

Existing Groundborne Vibration from UPRR

The Environmental Leadership Chapter also establishes a goal of minimizing vibration impacts on people, residences, and business operations. The applicable General Plan policies were presented above and are summarized below for the proposed project:

- The City's acceptable vibration level is 80 VdB for infrequent events (less than 30 events per day).

Vibration measurements made by *Illingworth & Rodkin, Inc.* at the nearby Cannery Park site in June 2008[2] (Appendix A) were used to estimate vibration levels expected at the proposed project site. Vibration measurements were taken at two setbacks from the railroad tracks. Position V-1 was approximately 40 feet from the center of the railroad tracks and Position V-2 was 80 feet from the center of the railroad tracks. The two setbacks were used to develop a drop-off rate for ground vibration with distance. Vibration levels were measured in the vertical axis because ground vibration is typically most dominant on this axis.

Vibration levels generated by two southbound and one northbound freight train pass-bys were measured. Trains were observed to travel slowly in the vicinity of the site at a speed of approximately 10 to 19 mph. Vibration levels ranged from approximately 77 to 83 VdB at a distance of 40 feet from the tracks and 69 to 77 VdB at 80 feet from the tracks. Based on these data, vibration levels expected at the portion of the building nearest the UPRR tracks are calculated to range from 75 to 81 VdB at a distance of 50 feet from the edge of the tracks. The U.S. Department of Transportation has developed vibration impact assessment criteria for evaluating vibration impacts associated with rapid transit projects.[3] As noted previously, the criterion for groundborne vibration impacts is 80 VdB for infrequent events (less than 30 events per day). [4]

Generalized predictions of groundborne vibration within residential units were then made following the Federal Transit Administration's (FTA) Transit Noise and Vibration Impact Assessment guidelines. Adjustments were made to the predicted vibration levels to account for the coupling loss between the proposed 18-story building and the ground (-10 dB), the amplification due to the resonance of the building (+6 dB), and floor-to-floor attenuation (-2 dB/floor for Floors 1 through 5, -1 dB/floor for Floors 5 through 10). Vibration levels at the first floor residential units are calculated to range from 69 to 75 VdB and from 67 to 73 VdB at second floor residential units. Vibration levels would continue to decrease as floor levels continue to ascend. Vibration levels produced by passing trains would not exceed the U.S. Department of Transportation's 80 VdB vibration impact assessment criteria at the nearest residential units to the UPRR; therefore the proposed project would be considered compatible with the vibration levels expected at the project site.

---

2 Illingworth & Rodkin, Inc., Cannery Park Project Environmental Noise Assessment, May 13, 2015.

3 U.S. Department of Transportation, Federal Transit Administration, Transit Noise and Vibration Impact Assessment, FTA-VA-90-1003-06, May 2006.

4 According to FTA, the criteria may be disregarded altogether for spur rail lines that carry very little rail traffic or have short trains. The spur rail adjoining the site carries very little rail traffic (1 to 3 short trains per day).

Groundborne Vibration from Construction

The construction of the project may generate vibration when heavy equipment or impact tools (e.g. jackhammers, hoe rams) are used. Construction activities would include the demolition of existing structures, site preparation work, excavation of the below-grade parking level, foundation work, paving, and new building framing and finishing. According to project plans and construction equipment information expected to be used for the proposed project, pile driving, which can cause excessive vibration, would be required.

According to Policy EC-2.3 of the City of San José General Plan, a vibration limit of 0.08 in/sec PPV shall be used to minimize the potential for cosmetic damage to sensitive historical structures, and a vibration limit of 0.2 in/sec PPV shall be used to minimize damage at buildings of normal conventional construction. With no known historical buildings in the vicinity of the project site, a significant impact would occur if nearby buildings were exposed to vibration levels in excess of 0.2 in/sec PPV.

Table 3 presents typical vibration levels that could be expected from construction equipment at a distance of 25 feet. Project construction activities, such as drilling, the use of jackhammers, rock drills and other high-power or vibratory tools, and rolling stock equipment (tracked vehicles, compactors, etc.), may generate substantial vibration in the immediate vicinity. Jackhammers typically generate vibration levels of 0.035 in/sec PPV, and drilling typically generates vibration levels of 0.09 in/sec PPV at a distance of 25 feet. Vibration levels would vary depending on soil conditions, construction methods, and equipment used. Use of pile drivers and to a lesser extent other construction equipment would require some attention to ensure that structures in the vicinity of the project, especially the buildings within 200 feet from such activities are sufficiently protected. Impact pile driving has the potential to generate the highest ground vibration levels and would be the primary concern to structural damage, particularly when it occurs within 100 to 200 feet of structures, given that impact pile driving could be anticipated to generate vibration levels of 0.644 in/sec PPV but could reach levels up to 1.158 in/sec PPV at 25 feet. Vibratory pile driving would produce less vibration than impact pile driving, but could still generate vibration levels of 0.17 in/sec PPV and could reach levels up to 0.734 in/sec PPV at 25 feet.

The residential and commercial land uses surrounding the project site include residences 75 feet northwest of the project property line opposite the UPRR, residences 220 feet northeast opposite the UPRR, residences 260 feet east opposite Coleman Avenue, and commercial buildings 575 feet south opposite W. Julian Street. At these distances for all the locations other than the northwest residences, vibration levels due to impact pile driving activity would be at or below 0.11 in/sec PPV and vibration levels due to construction activity would be at or below 0.02 in/sec PPV, which would both be below the 0.2 in/sec PPV significance threshold. At the residences to the northwest, vibration levels from impact pile driving would typically be up to 0.19 in/sec PPV but could reach levels up to 0.35 in/sec PPV, and vibration levels from vibratory pile driving would typically be 0.05 in/sec PPV but could reach levels up to 0.22 in/sec PPV. Other non-pile driving construction activities would produce vibration levels of up to 0.06 in/sec PPV. Impact and vibratory piling driving would typically be under the vibration significance threshold, but could reach vibration levels that would be above the 0.2 in/sec PPV significance threshold. In addition, the proposed residences to the west would be at a similar distance from the project site as the residences to the northwest. It would therefore have the same construction vibration exposure and levels, in which upper level pile driving activities would be above the significance threshold.

TABLE 3 Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 ft. (in/sec)	Approximate L_v at 25 ft. (VdB)
Pile Driver (Impact)	upper range	1.158	112
	typical	0.644	104
Pile Driver (Sonic)	upper range	0.734	105
	typical	0.170	93
Clam shovel drop		0.202	94
Hydromill (slurry wall)	in soil	0.008	66
	in rock	0.017	75
Vibratory Roller		0.210	94
Hoe Ram		0.089	87
Large bulldozer		0.089	87
Caisson drilling		0.089	87
Loaded trucks		0.076	86
Jackhammer		0.035	79
Small bulldozer		0.003	58

Source: Transit Noise and Vibration Impact Assessment, United States Department of Transportation, Office of Planning and Environment, Federal Transit Administration, May 2006.

Mitigation Measure:

The following measures are recommended to reduce vibration impacts from construction activities to be compatible with the project:

- A list of pile driving equipment to be used for this project and the anticipated time duration of using the equipment shall be submitted by the contractor. This list shall be used to identify equipment and activities that would potentially generate substantial vibration and to define the level of effort required for continuous vibration monitoring. Where possible, use of the heavy vibration-generating construction equipment shall be prohibited within 30 feet of any adjacent building.

- A construction vibration monitoring plan shall be implemented to document conditions prior to, during, and after vibration generating pile driving construction activities. All plan tasks shall be undertaken under the direction of a licensed Professional Structural Engineer in the State of California and be in accordance with industry-accepted standard methods. The construction vibration monitoring plan should be implemented to include the following tasks:

    - Identification of the sensitivity of nearby structures to groundborne vibration. Vibration limits should be applied to all vibration-sensitive structures located within 130 feet of pile driving construction activities identified as sources of high vibration levels.

  - Performance of a photo survey, elevation survey, and crack monitoring survey for each structure within 130 feet of pile driving construction activities identified as sources of high vibration levels. Surveys shall be performed prior to any pile driving construction activity, in regular interval during construction and after project completion and shall include internal and external crack monitoring in structures, settlement, and distress and shall document the condition of foundations, walls and other structural elements in the interior and exterior of said structures.

  - Development of a vibration monitoring and construction contingency plan to identify structures where monitoring would be conducted, set up a vibration monitoring schedule, define structure-specific vibration limits, and address the need to conduct photo, elevation, and crack surveys to document before and after construction conditions. Construction contingencies would be identified for when vibration levels approached the limits.

  - At a minimum, vibration monitoring should be conducted during pile driving activities. Monitoring results may indicate the need for more or less intensive measurements.

  - If vibration levels approach limits, suspend construction and implement contingencies to either lower vibration levels or secure the affected structures.

  - Designate a person responsible for registering and investigating claims of excessive vibration. The contact information of such person shall be clearly posted on the construction site.

  - Conduct post-survey on structures where either monitoring has indicated high levels or complaints of damage has been made. Make appropriate repairs or compensation where damage has occurred as a result of construction activities.

- The results of all vibration monitoring shall be summarized and submitted in a report shortly after substantial completion of each phase identified in the project schedule. The report will include a description of measurement methods, equipment used, calibration certificates, and graphics as required to clearly identify vibration-monitoring locations. An explanation of all events that exceeded vibration limits will be included together with proper documentation supporting any such claims.

Applying the above recommendations to the proposed project would reduce pile driving construction vibration levels to be compatible with the project.

Appendix A

Cannery Park Project Environmental Noise Assessment

CANNERY PARK PROJECT ENVIRONMENTAL NOISE ASSESSMENT SAN JOSE, CALIFORNIA

May 13, 2015

◆ ◆ ◆

Prepared for:

Leianne Humble
Denise Duffy & Associates, Inc.
947 Cass Street, Suite 5
Monterey, CA 93940

Prepared by:

Dana M. Lodico, PE, INCE Bd. Cert.

ILLINGWORTH & RODKIN, INC.
Acoustics · Air Quality
1 Willowbrook Court, Suite 120
Petaluma, CA 94952
(707) 794-0400

Job No.: 14-164

INTRODUCTION

This report presents the results of the environmental noise and vibration assessment prepared for the Cannery Park mixed-use project, proposed northwest of the North 10th Street and East Taylor Street intersection in San Jose, California. The project would construct a four-story residential building with parking garage, and about 5,000 sq. ft. of ground level retail space. The Setting section of this report presents the fundamentals of environmental noise and vibration, provides a discussion of policies and standards applicable to the project, and presents the results of noise and vibration measurements made at the project site. The Impacts and Mitigation Measures section of the report summarizes future noise level calculations and provides an evaluation of the significance of impacts resulting from the project. Mitigation measures are presented to reduce potentially significant impacts to less-than-significant levels.

SETTING

Fundamentals of Environmental Noise

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound could be caused by its *pitch* or its *loudness*. *Pitch* is the height or depth of a tone or sound, depending on the relative rapidity (frequency) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. *Loudness* is intensity of sound waves combined with the reception characteristics of the ear. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave.

In addition to the concepts of pitch and loudness, there are several noise measurement scales which are used to describe noise in a particular location. A *decibel (dB)* is a unit of measurement which indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10 decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Technical terms are defined in Table 1.

There are several methods of characterizing sound. The most common in California is the *A-weighted sound level* (*dBA).* This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This *energy-equivalent sound/noise descriptor* is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

The scientific instrument used to measure noise is the sound level meter. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends upon the distance the receptor is from the noise source. Close to the noise source, the models are accurate to within about plus or minus 1 to 2 dBA.

Since the sensitivity to noise increases during the evening and at night -- because excessive noise interferes with the ability to sleep -- 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The *Community Noise Equivalent Level* (*CNEL*) is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to evening (7:00 pm - 10:00 pm) and a 10 dB addition to nocturnal (10:00 pm - 7:00 am) noise levels. The *Day/Night Average Sound Level* (*DNL* or L_{dn}) is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.

Fundamentals of Groundborne Vibration

Ground vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One method is the *Peak Particle Velocity (PPV)*. The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. In this report, a PPV descriptor with units of mm/sec or in/sec is used to evaluate construction generated vibration for building damage and human complaints. Table 3 displays the reactions of people and the effects on buildings that continuous vibration levels produce.

The annoyance levels shown in Table 3 should be interpreted with care since vibration may be found to be annoying at much lower levels than those shown, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying. Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage.

Construction activities can cause vibration that varies in intensity depending on several factors. The use of pile driving and vibratory compaction equipment typically generates the highest construction related groundborne vibration levels. Because of the impulsive nature of such activities, the use of the PPV descriptor has been routinely used to measure and assess groundborne vibration and almost exclusively to assess the potential of vibration to induce structural damage and the degree of annoyance for humans.

The two primary concerns with construction-induced vibration, the potential to damage a structure and the potential to interfere with the enjoyment of life are evaluated against different vibration limits. Studies have shown that the threshold of perception for average persons is in the range of 0.008 to 0.012 in/sec PPV. Human perception to vibration varies with the individual and is a function of physical setting and the type of vibration. Persons exposed to elevated ambient vibration levels, such as people in an urban environment, may tolerate a higher vibration level.

Structural damage can be classified as cosmetic only, such as minor cracking of building elements, or may threaten the integrity of the building. Safe vibration limits that can be applied to assess the potential for damaging a structure vary by researcher and there is no general consensus as to what amount of vibration may pose a threat for structural damage to the building. Construction-induced vibration that can be detrimental to the building is very rare and has only been observed in instances where the structure is at a high state of disrepair and the construction activity occurs immediately adjacent to the structure.

TABLE 1 Definition of Acoustical Terms Used in this Report

Term	Definition
Decibel, dB	A unit describing, the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20 micro Pascals.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e. g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sound are below 20 Hz and Ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level, L_{eq}	The average A-weighted noise level during the measurement period.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Day/Night Noise Level, L_{dn} or DNL	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 pm and 7:00 am.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 pm to 10:00 pm and after addition of 10 decibels to sound levels measured in the night between 10:00 pm and 7:00 am.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Source: Handbook of Acoustical Measurements and Noise Control, Harris, 1998.

TABLE 2 Typical Noise Levels in the Environment

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	110 dBA	Rock band
Jet fly-over at 1,000 feet		
	100 dBA	
Gas lawn mower at 3 feet		
	90 dBA	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	80 dBA	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawn mower, 100 feet	70 dBA	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	60 dBA	
		Large business office
Quiet urban daytime	50 dBA	Dishwasher in next room
Quiet urban nighttime	40 dBA	Theater, large conference room
Quiet suburban nighttime		
	30 dBA	Library
Quiet rural nighttime		Bedroom at night, concert hall
	20 dBA	
		Broadcast/recording studio
	10 dBA	
	0 dBA	

Source: Technical Noise Supplement (TeNS), California Department of Transportation, September 2013.

TABLE 3 Reaction of People and Damage to Buildings from Continuous or Frequent Intermittent Vibration Levels

Velocity Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.01	Barely perceptible	No effect
0.04	Distinctly perceptible	Vibration unlikely to cause damage of any type to any structure
0.08	Distinctly perceptible to strongly perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
0.1	Strongly perceptible	Virtually no risk of damage to normal buildings
0.3	Strongly perceptible to severe	Threshold at which there is a risk of damage to older residential dwellings such as plastered walls or ceilings
0.5	Severe - Vibrations considered unpleasant	Threshold at which there is a risk of damage to newer residential structures

Source: Transportation and Construction Vibration Guidance Manual, California Department of Transportation, September 2013.

Regulatory Criteria - Noise

The project would be subject to noise-related regulations, plans, and policies established by the State of California, Santa Clara County, and the City of San Jose. These planning documents are implemented during the environmental review process to limit noise exposure at existing and proposed noise sensitive land uses.

Applicable planning documents include: (1) the California Environmental Quality Act (CEQA) Guidelines, Appendix G, (2) the Santa Clara County Airport Land Use Commission's (ALUC) Land Use Plan, (3) the City of San Jose Noise Element of the General Plan, (4) the City of San Jose's Municipal Code, and (5) the Federal Transit Administration (FTA). Regulations, plans, and policies presented within these documents form the basis of the significance criteria used to assess project impacts.

State CEQA Guidelines. The CEQA contains guidelines to evaluate the significance of effects of environmental noise attributable to a proposed project. CEQA asks the following applicable questions. Would the project result in:

(a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;

(b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels;

(c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;

(d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project;

(e) For a project located within an airport land use plan or where such a plan has not been adopted within two miles of a public airport or public use airport, if the project would expose people residing or working in the project area to excessive noise levels;

(f) For a project within the vicinity of a private airstrip, if the project would expose people residing or working in the project area to excessive noise levels?

Of these guidelines, items (a), (b), (c), (d), and (e) are applicable to the proposed project. Guideline (f) is not applicable because the project is not located in the vicinity of a private airstrip.

Santa Clara County Airport Land Use Commission's (ALUC) Land Use Plan. The Santa Clara County ALUC has adopted a Land Use Compatibility Chart (not shown) for projects within the vicinity of Mineta San Jose International Airport. The chart indicates that project residential land uses are compatible in noise environments less than 65 dBA CNEL.

City of San Jose General Plan. The Environmental Leadership Chapter in The Envision San Jose 2040 General Plan sets forth policies related to noise and vibration control in the City of San Jose. The following policies are applicable to the proposed development.

Goal EC-1: Noise

EC-1.1 Locate new development in areas where noise levels are appropriate for the proposed uses. Consider federal, state and City noise standards and guidelines as a part of new development review. Applicable standards and guidelines for land uses in San Jose include:

Interior Noise Levels

The City's standard for interior noise levels in residences, hotels, motels, residential care facilities, and hospitals is 45 dBA DNL. Include appropriate site and building design, building construction and noise attenuation techniques in new development to meet this standard. For sites with exterior noise levels of 60 dBA DNL or more, an acoustical analysis following protocols in the City-adopted California Building Code is required to demonstrate that development projects can meet this standard. The acoustical analysis shall base required noise attenuation techniques on expected Envision General Plan traffic volumes to ensure land use compatibility and General Plan consistency over the life of this plan.

Exterior Noise Levels

The City's acceptable exterior noise level objective is 60 dBA DNL or less for residential and most institutional land uses. For new multi-family residential projects and for the residential component of mixed-use development, use a standard of 60 dBA DNL in usable outdoor activity areas, excluding balconies and residential stoops and porches facing existing roadways. Some common use areas that meet the 60 dBA DNL exterior standard will be available to all residents. Use noise attenuation techniques such as shielding by buildings and structures for outdoor common use areas. On sites subject to aircraft overflights or adjacent to elevated roadways, use noise attenuation techniques to achieve the 60 dBA DNL standard for noise from sources other than aircraft and elevated roadway segments.

Table EC-1 (not shown) establishes that residential land uses are considered "normally acceptable" in exterior noise exposures up to 60 dBA DNL and that where the exterior noise exposure is between 60 dBA and 75 dBA DNL residential land uses are considered "conditionally acceptable" such that the specified land use may be permitted only after detailed analysis of the noise reduction requirements and needed noise insulation features included in the design. Residential land uses are considered "unacceptable" in noise environments exceeding 75 dBA DNL.

EC-1.2 Minimize the noise impacts of new development on land uses sensitive to increased noise levels (Categories 1, 2, 3 and 6) by limiting noise generation and by requiring use of noise attenuation measures such as acoustical enclosures and sound barriers, where feasible. The City considers significant noise impacts to occur if a project would:

- Cause the DNL at noise sensitive receptors to increase by five dBA DNL or more where the noise levels would remain "Normally Acceptable"; or
- Cause the DNL at noise sensitive receptors to increase by three dBA DNL or more where noise levels would equal or exceed the "Normally Acceptable" level.

EC-1.3 Mitigate noise generation of new nonresidential land uses to 55 dBA DNL at the property line when located adjacent to existing or planned noise sensitive residential and public/quasi-public land uses.

EC-1.6 Regulate the effects of operational noise from existing and new industrial and commercial development on adjacent uses through noise standards in the City's Municipal Code.

EC-1.7 Require construction operations within San Jose to use best available noise suppression devices and techniques and limit construction hours near residential uses per the City's Municipal Code. The City considers significant construction noise impacts to occur if a project located within 500 feet of residential uses or 200 feet of commercial or office uses would:

- Involve substantial noise generating activities (such as building demolition, grading, excavation, pile driving, use of impact equipment, or building framing) continuing for more than 12 months.

For such large or complex projects, a construction noise logistics plan that specifies hours of construction, noise and vibration minimization measures, posting or notification of construction schedules, and designation of a noise disturbance coordinator who would respond to neighborhood complaints will be required to be in place prior to the start of construction and implemented during construction to reduce noise impacts on neighboring residents and other uses.

EC-1.9 Require noise studies for land use proposals where known or suspected loud intermittent noise sources occur which may impact adjacent existing or planned land uses. For new residential development affected by noise from heavy rail, light rail, BART or other single-event noise sources, implement mitigation so that recurring maximum instantaneous noise levels do not exceed 50 dBA L_{max} in bedrooms and 55 dBA L_{max} in other rooms.

EC-1.11 Require safe and compatible land uses within the Mineta International Airport noise zone (defined by the 65 CNEL contour as set forth in State law) and encourage aircraft operating procedures that minimize noise.

Goal EC-2: Vibration

EC-2.1 Near light and heavy rail lines or other sources of groundborne vibration, minimize vibration impacts on people, residences, and businesses through the use of setbacks and/or structural design features that reduce vibration to levels at or below the guidelines of the Federal Transit Administration. Require new development within 100 feet of rail lines to demonstrate prior to project approval that vibration experienced by residents and vibration sensitive uses would not exceed these guidelines.

EC-2.2 Require new sources of groundborne vibration, such as transit along fixed rail systems or the operation of impulsive equipment, to minimize vibration impacts on existing sensitive land uses to levels at or below the guidelines of the Federal Transit Administration.

EC-2.3 Require new development to minimize vibration impacts to adjacent uses during demolition and construction. For sensitive historic structures, a vibration limit of 0.08 in/sec PPV will be used to minimize the potential for cosmetic damage to a building. A vibration limit of 0.20 in/sec PPV will be used to minimize the potential for cosmetic damage at buildings of normal conventional construction.

City of San Jose Municipal Code. The City's Municipal Code contains a Zoning Ordinance that limits noise levels at any residential property to 55 dBA. The code is not explicit in terms of the acoustical descriptor associated with the noise level limit. A reasonable interpretation of this standard has been made based on similar codes of other Bay Area communities. This analysis assumes that the intent of the code is to limit noise levels at any residential property to 55 dBA L_{eq}.

Federal Transit Administration (FTA). The City of San Jose has not identified quantifiable vibration limits that can be used to evaluate the compatibility of land uses with respect to vibration levels generated by railroad trains. Although there are no local standards that control the allowable vibration in a new residential development, the U.S. Department of Transportation has developed vibration impact assessment criteria for evaluating vibration impacts associated with transit projects.[1] The FTA has proposed vibration impact criteria, based on maximum overall levels for a single event. The impact criteria for groundborne vibration are shown in Table 4. Note that there are criteria for frequent events (more than 70 events of the same source per day), occasional events (30 to 70 vibration events of the same source per day), and infrequent events (less than 30 vibration events of the same source per day).

TABLE 4 Groundborne Vibration Impact Criteria

Land Use Category	Groundborne Vibration Impact Levels (VdB re 1 µinch/sec, RMS)		
	Frequent Events[1]	**Occasional Events[2]**	**Infrequent Events[3]**
Category 1 Buildings where vibration would interfere with interior operations.	65 VdB[4]	65 VdB[4]	65 VdB[4]
Category 2 Residences and buildings where people normally sleep.	72 VdB	75 VdB	80 VdB
Category 3 Institutional land uses with primarily daytime use.	75 VdB	78 VdB	83 VdB

Notes:

1. "Frequent Events" is defined as more than 70 vibration events of the same source per day. Most rapid transit projects fall into this category.
2. "Occasional Events" is defined as between 30 and 70 vibration events of the same source per day. Most commuter trunk lines have this many operations.
3. "Infrequent Events" is defined as fewer than 30 vibration events of the same kind per day. This category includes most commuter rail branch lines.
4. This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration sensitive manufacturing or research should always require detailed evaluation to define the acceptable vibration levels. Ensuring low vibration levels in a building requires special design of HVAC systems and stiffened floors.

Source: U.S. Department of Transportation, Federal Transit Administration, Transit Noise and Vibration Impact Assessment, May 2006, FTA-VA-90-1003-06.

Existing Noise Environment

The Cannery Park project is located northwest of the intersection of North 10th Street and East Taylor Street in San Jose, California. The project site is bordered by residential, commercial, and industrial uses, with the Union Pacific Railroad (UPRR) located to the west of the site. The nearest noise sensitive uses are located to the west across the UPRR, along North 10th Street, south of East Taylor Street, and a block east of the site along North 11th Street. Residential land uses are

[1]U.S. Department of Transportation, Federal Transit Administration, Transit Noise and Vibration Impact Assessment, May 2006, FTA-VA-90-1003-06.

currently under construction north and east of the project site. The existing noise environment results primarily from traffic on North 10th Street and East Taylor Street, with occasional noise generated by railroad movements and aircraft flying over the site.

A noise monitoring survey was conducted from June 25, 2008 to June 27, 2008 to quantify the existing noise environment at the project site and in the project vicinity. Additional site visits and noise monitoring surveys were conducted on October 9, 2014 and April 14-16, 2015 to confirm and update the noise data collected during the 2008 survey and to note any changes in land uses in the project vicinity. The 2008 noise monitoring survey included three long-term noise measurements (LT-1, LT-2, LT-3), and one short-term measurement (ST-1), as shown in Appendix A. The 2014 noise monitoring survey included two short-term noise measurements (ST-2 and ST-3), also shown in Appendix A. The 2015 noise monitoring survey included one long-term (LT-4) and several localized spot measurements to assess noise levels generated by the Gordon Brewery compressors. Table 5 summarizes the results of the short-term noise measurements. Appendix B summarizes the data collected at the long-term noise measurement sites.

Long-term noise measurement LT-1 was located on the site's southernmost property line, approximately 25 feet from the center of East Taylor Street and about 12 feet above the surrounding ground. Noise levels measured at this site were primarily the result of vehicular traffic along East Taylor Street. Hourly average noise levels typically ranged from 65 to 72 dBA L_{eq} during the day, and from 54 to 69 dBA L_{eq} at night. The calculated day-night average noise level at this location was 71 dBA DNL on June, 26, 2008. Based on the 2014 noise measurements, noise levels at this location have increased by about 2 dBA.

Long-term noise measurement location LT-2 was at the western edge of the property, adjacent to the UPRR. The primary noise sources at this location were distant traffic, railroad trains and aircraft, and truck activities in the existing parking lot. Hourly average noise levels typically ranged from 52 to 64 dBA L_{eq} during the day, and from 45 to 62 dBA L_{eq} at night. The calculated day-night average noise level at this location was 62 dBA DNL.

Long-term noise measurement LT-3 was made in the center of the project site, adjacent to the existing Gordon Biersch Brewery. The primary noise sources at this location were distant traffic, railroad trains, and truck and vehicle activities in the existing parking lot. Hourly average noise levels typically ranged from 52 to 62 dBA L_{eq} during the day, and from 47 to 58 dBA L_{eq} at night. The calculated day-night average noise level at this location was 62 dBA DNL.

Noise measurement LT-4 was made in 2015 across the parking lot and 145 feet east of Gordon Brewery. The purpose of this measurement was to measure the diurnal trend in noise levels generated by the brewery compressors with minimal intrusion from other noise sources. Review of Figure A-10 and A-11 in the Appendix show that noise levels at this location were strongly related to the operation of the compressors, with minimum noise levels oscillating between approximately 55 dBA and 62 to 63 dBA L_{min} over a cycle of 1 to 4 hours, 24 hours per day. The calculated day-night average noise level at this location ranged from 68 to70 dBA DNL, depending on the nighttime operation of the compressors. A comparison between Figures A-10 to 11 and Figures A-7 to 9 indicate that the compressor noise source was not present and/or operating during the 2008 measurements at LT-3. Spot measurements made at the setback of the proposed residences with the worst-case noise exposure from the compressors indicate that compressor noise is about 4 dB higher at the worst-case exposure setback of the proposed residences than the levels measured at LT-4. Spot measurements made at distances of 25 and 50 feet from the brewery building vents in direct line-of-sight to the compressors indicate that compressor noise is dropping off at a rate of about 3 dB per doubling of distance from these vents.

Aircraft noise levels at the project site were established based on the 2014 Quarterly 65 Contour Maps prepared by Mineta San Jose International Airport. Aircraft generate noise levels less than 60 dBA CNEL at the site.

TABLE 5 Summary of Short-Term Noise Measurement Data

Noise Measurement Location	L_{max}	$L_{(1)}$	$L_{(10)}$	$L_{(50)}$	$L_{(90)}$	L_{eq}	DNL
ST-1: ~30 feet from the center of North 10th Street (6/27/2008, 11:10-11:20 am)	76	72	67	56	51	63	70
ST-2: ~55 feet from the center of Taylor Street (with train) (10/9/2014, 12:10-12:20 pm)	82	75	69	63	57	66	69
ST-3: ~55 feet from the center of North 10th Street (10/9/2014, 12:30-12:40 pm)	74	72	67	60	55	63	70

Note: DNL approximated by correlating to corresponding period at long-term site.

Existing Vibration Environment

Vibration measurements were made on Friday June 27, 2008. Since the site is setback 100 feet or more from the tracks and rail conditions have not changed in this time, vibration measurements were not repeated from the 2008 survey. Vibration measurements were conducted using a Sony Digital Audio Tape Recorder (DAT) and seismic grade, low noise accelerometers firmly fixed to the ground. This system is capable of accurately measuring very low vibration levels. Vibration levels were measured at ground level and were representative of the levels that would enter a building's foundation.

Vibration measurements were taken at two setbacks from the UPRR line. Position V-1 was approximately 40 feet from the center of the railroad tracks and Position V-2 was 80 feet from the center of the railroad tracks, as shown in Appendix A. The two setbacks were used to develop a drop-off rate for ground vibration with distance. Vibration levels were measured in the vertical axis because ground vibration is typically most dominant on this axis.

Vibration levels generated by two southbound and one northbound freight train passbys were measured. Trains were observed to travel slowly in the vicinity of the site at a speed of approximately 10 to 19 mph. Vibration levels measured at each measurement position during train passby events are summarized in Table 6. Vibration levels ranged from approximately 77 to 83 VdB at a distance of 40 feet from the tracks and 69 to 77 VdB at 80 feet from the tracks.

TABLE 6 Results of Vibration Measurements

Event	Maximum Vibration Level (VdB re 1µinch/sec, RMS)		Comments
	Position V-1	Position V-2	
SB Freight (9:08 a.m.)	83 VdB	77 VdB	10 mph
NB Freight (10:48 a.m.)	81 VdB	69 VdB	19 mph
SB Freight (10:57 a.m.)	77 VdB	71 VdB	12 mph

Notes: Position V-1 - 40 feet from the center of the UPRR
Position V-2 - 80 feet from the center of the UPRR
RMS – root-mean-square

IMPACT AND MITIGATION MEASURES

Significance Criteria

The following significance criteria are used in this report to evaluate the significance of noise impacts:

1. **Noise and Land Use Compatibility.** If proposed residential uses are exposed to a DNL in excess of City, County or, State regulatory criteria, the impact would be considered significant (65 dBA CNEL for airport generated noise sources, 60 dBA DNL for exterior common use areas, and 45 dBA DNL for interior residential uses);

2. **Project Generated Traffic Noise.** If project traffic were to increase noise levels at noise sensitive areas by more than 3 dBA DNL, the impact would be considered significant;

3. **Construction Noise.** Construction noise impacts would be considered significant for a project located within 500 feet of residential uses or 200 feet of commercial or office uses would involve substantial noise generating activities (such as building demolition, grading, excavation, pile driving, use of impact equipment, or building framing) continuing for more than 12 months;

4. **Railroad Vibration.** A significant noise impact would result if the project would locate vibration sensitive land uses in areas where vibration levels from freight trains or commuter trains exceeds 80 VdB for “infrequent” vibration events (less than 30 events of the same source per day);

5. **Construction Vibration.** Construction vibration impacts would be considered significant when construction activities are anticipated to generate a peak vertical particle velocity of 0.20 in/sec PPV at adjacent commercial and residential structures (assumed to be structurally sound); and

6. **Aircraft Noise.** A significant impact would be identified if the project site were located in an area where aircraft operations exceed 65 CNEL.

Impact 1: **Noise and Land Use Compatibility.** Future residential uses developed at the project site would be exposed to exterior noise levels exceeding the City's exterior noise level goals (65 dBA CNEL for airport generated noise sources, 60 dBA DNL for exterior common use areas). Interior noise levels could exceed the City's interior noise level goal of 45 dBA DNL without the incorporation of noise insulation features into the project's design. **This is a potentially significant impact.**

Exterior Noise and Land Use Compatibility with Transportation Noise Sources

The existing noise environment at the project site exceeds the City's noise level goal for exterior noise at residential uses (65 dBA CNEL for airport generated noise sources, 60 dBA DNL for exterior common use areas) as a result of vehicular traffic along North 10th Street, East Taylor Street, compressor noise from the Gordon Brewery, aircraft, and railroad trains from the Union Pacific Railroad (UPRR), located 175 feet west of and on a diagonal to the site. Cumulative traffic noise levels are calculated to increase by 2 dBA DNL along adjacent roadways. Many of the surrounding uses have been redeveloped from commercial and industrial uses to residential uses since the initial project noise study was conducted in 2008. As the site vicinity continues to redevelops with planned residential uses, local commercial and industrial noises will continue to become a less significant source of community noise.

Noise levels throughout the site exceed 60 dBA DNL due to aircraft operations. Future noise levels are calculated to be about 63 dBA DNL nearest the railroad along 9th Street, about 72 dBA DNL at the facades of residential buildings proposed along East Taylor Street, and about 71 dBA DNL at the facades of residential buildings proposed along North 10th Street. Noise levels at residences proposed in direct line of sight and nearest to the Gordon Brewery compressors reach 64 to 65 dBA L_{eq} during operation of the compressors, taking into account noise generated by transportation noise sources at the site. Additionally, only 2 of the 3 compressors were present during the measurements. With 3 compressors running, the overall noise exposure would be about 66 dBA L_{eq}. This would result in DNL noise exposures of 69 to 71 dBA, depending on the nighttime duration of the compressor use.

The site plan indicates that common open space areas within courtyards would be well shielded from East Taylor Street, the compressors, and the railroad and partially or fully shielded from North 10th Street. The noise level in common outdoor recreation areas would exceed 60 dBA DNL due to aircraft operations. However, the City of San Jose allows for an exterior noise levels up to 65 dBA CNEL for airport generated noise sources. Exterior noise levels would be expected to be less than 65 dBA DNL in shielded and partially shielded common use areas.

Future Interior Noise Environment

Future noise levels at the project site would require that residential units be designed to control interior noise levels to 45 dBA DNL or less. Standard residential construction provides approximately 15 dBA of exterior to interior noise reduction assuming the windows are partially open for ventilation. Standard construction with the windows closed provides approximately 20 to 25 dBA of noise reduction in interior spaces. Where exterior day-night average noise levels are less than 65 to 70 dBA DNL, interior noise levels can typically be maintained below City standards (45 dBA DNL) with the incorporation of forced air mechanical ventilation systems in residential units. These systems allow the occupant the option of controlling noise by maintaining the windows shut. Where noise levels exceed 65 to 70 dBA DNL, such as residences facing East Taylor Street and North 10th Street, forced-air mechanical ventilation systems and sound-rated construction would be required. Due to the nighttime operations of the Gordon Brewery compressors, it is recommended that interior levels be controlled to 40 dBA L_{eq} inside bedrooms in units adjacent to the brewery. This is in line with the Municipal Code, which limits operational noise sources to 55 dBA L_{eq} at residential uses.

Interior noise levels would vary depending on the design of the building (relative window area to wall area) and construction materials and methods. Specifications of window and wall systems can be determined during the final design stage of the project when building elevations and floor plans are available, but would likely include a forced air mechanical ventilation systems, standard wall construction methods, and windows and doors with Sound Transmission Class (STC) ratings of 28 to 32.

Residential Compatibility with Retail and Restaurant Operational Noise

The proposed project would introduce new sources of noise into the existing noise environment. Typical noise sources would include rooftop heating ventilating and air-conditioning (HVAC) equipment and truck deliveries to the retail space, located in the southeast corner of the site. The nearest noise sensitive uses to the retail space are residences located about 150 feet to the south and east. In addition, project residences would be directly adjacent to the retail space. Noise impacts resulting from HVAC systems can vary considerably depending on the equipment selected, the system design, and the location of the equipment relative to the noise sensitive use. Noise levels from commercial HVAC systems are typically in the range of 60 to 70 dBA L_{eq} at a distance of 15 feet. At a distance of 150 feet, noise levels would be 20 dBA lower, in the range of 40 to 50 dBA L_{eq}. Maximum instantaneous noise levels generated by delivery trucks are generally in the range of 60 to 70 dBA L_{max} at a distance of 50 feet, similar to noise levels generated by local traffic. Residences adjacent to the retail space are exposed to existing ambient noise levels of about 70 dBA DNL. Delivery truck and HVAC noise would not generally be distinguishable from ambient noise sources.

Mitigation Measure N-1:

The following mitigation measures shall be included in the project to reduce the impact to a less-than-significant level:

- When refining the project's site plan, continue to locate common outdoor areas away from adjacent noise sources and shield noise-sensitive spaces with buildings, noise barriers, or parapet walls whenever possible.

- Incorporate building design and treatments to ensure compliance with State and City noise standards. A project-specific acoustical analysis would be required by the City of San Jose to insure that the design of the project incorporates controls so that interior noise levels will be reduced to 45 dBA DNL or lower in all units and noise levels in bedrooms adjacent to the Gordon Brewery be designed to reduce nighttime noise levels to 40 dBA L_{eq} or less. Building sound insulation requirements would need to include the provision of forced-air mechanical ventilation for all residential units, so that windows could be kept closed at the occupant's discretion to control noise, including noise from aircraft. Special building construction techniques (e.g., sound-rated windows and doors and building facade treatments) may be required for residential units with line-of-sight to East Taylor Street and/or North 10th Street. These treatments could include sound rated windows and doors, sound rated wall constructions, acoustical caulking, etc. Pursuant to the State Building Code the results of the analysis, including a description of the necessary noise control measures, would be submitted to the City along with the building plans and approved prior to issuance of a building permit. Feasible construction techniques such as these would adequately reduce interior noise levels to 45 dBA DNL or lower.

- A qualified acoustical consultant should review final site plan, building elevations, and floor plans prior to construction to calculate expected interior and exterior noise levels and ensure compliance with City policies and State noise regulations.

With the incorporation of measures provided above, the interior and exterior project uses would meet the City's noise and land use compatibility goals.

Impact 2a: **Off-Site Project-Generated Traffic Noise.** The proposed project will generate an increase in traffic volumes along area roadways. The increase in traffic would not result in a substantial increase in traffic noise at nearby sensitive receivers. **This is a less-than-significant impact.**

A review of the project's traffic study indicates that the proposed project will generate a slight increase in vehicular traffic on the local roadway network. The addition of project traffic would increase noise levels by less than 1 dBA DNL at receivers along roadway segments in the project's vicinity. Increases of less than 1 dBA DNL are not measurable and are not considered substantial. This is a less-than-significant impact.

Mitigation Measures: **None Required.**

Impact 2b: **Cumulative Project-Generated Traffic Noise.** The proposed project would not substantially contribute to cumulative noise levels anticipated with the build-out of General Plan. **This is a less-than-significant impact.**

Traffic noise levels along roadways serving the project site vicinity will increase by 1 to 2 dBA DNL under cumulative plus project conditions along most roadways in the vicinity of the project. Traffic noise levels along 7th Street, south of Taylor Street are anticipated to increase by 4 dBA DNL under cumulative plus project conditions. The project's contribution to cumulative noise level increases would be less than 1 dBA DNL. The project would not make a cumulatively considerable contribution to increased noise levels resulting from the build-out of the area. **This is a less-than-significant impact.**

Mitigation Measures: None Required.

Impact 3: **Construction Noise.** Noise generated by construction activities at the site would be within 500 feet of residences and is anticipated to occur over a period greater than 12 months. **This is a potentially significant impact.**

Pre-Construction

Soil extraction units are anticipated to run 24/7 for a period of 6 weeks prior to general construction. The units would be located in the 9th Street corridor between the cannery warehouse building and the building at 775 North 10th Street. The units include a generator and a vacuum pump (VLR 500) and would be located inside a box truck. The generator is specified to generate a noise level of 63 dBA at a distance of 23 feet and the VLR 500 pump is specified to generate a noise level of 82 dBA (assumed to be at a distance of 3 feet). The truck enclosure would be anticipated to provide an insertion loss of about 15 to 20 dB.

The units would be more than 500 feet from residences to the south and about 350 feet and well shielded from residences to the east. Some residences to the north and west could be located as close as 100 to 150 feet from the units. Using a standard drop off rate of 6 dB per doubling of distance, noise levels are calculated to be less than 45 dBA at the closest residences to the north and less than 40 dBA at residences to the east and south. Noise levels would be lower as units move away from sensitive locations or are shielded by intervening structures.

Noise sensitive uses located south of the site along East Taylor Street and east of the site along North 10th Street are exposed to existing noise levels of about 70 and 69 dBA DNL, respectfully. Soil extraction units would not generally be audible at these locations during daytime or nighttime hours. At land uses to the west and north, which are exposed to ambient noise levels around 62 dBA DNL, the soil extraction units would not generally be audible during daytime hours, but could, at time, be audible at night when the units are located closest to the homes and in unshielded locations. However, nighttime use of the units would occur for a period of only 6 weeks and would not be anticipated to exceed 60 dBA L_{eq} at these residences. This is a less than significant impact.

Project Construction

Residential land uses are located to the west, east, and south of the project site. Construction activities generate considerable amounts of noise. Construction-related noise levels are normally highest during the demolition phase and during the construction of project infrastructure. These phases of construction require heavy equipment that normally generates the highest noise levels over extended periods of time. Typical hourly average construction generated noise levels are about 81 to 88 dBA L_{eq} measured at a distance of 50 feet from the center of the site during busy construction periods (e.g., earth moving equipment, impact tools, etc.) Construction-related noise levels are normally less during building erection, finishing, and landscaping phases. There would be variations in construction noise levels on a day-to-day basis depending on the actual activities occurring at the site. Construction generated noise levels drop off at a rate of about 6 dBA per doubling of distance between the source and receptor.

Noise impacts resulting from construction depend on the noise generated by various pieces of construction equipment, the timing and duration of noise generating activities, and the distance between construction noise sources and noise sensitive receptors. Construction noise impacts primarily occur when construction activities occur during noise-sensitive times of the day (early morning, evening, or nighttime hours), the construction occurs in areas immediately adjoining noise sensitive land uses, or when construction durations last over extended periods of time. The City considers significant construction noise impacts to occur if a project located within 500 feet of residential uses or 200 feet of commercial or office uses would involve substantial noise generating activities (such as building demolition, grading, excavation, pile driving, use of impact equipment, or building framing) continuing for more than 12 months.

Construction is anticipated to occur from 6:00 a.m. to 6:00 p.m., Monday through Saturday, over a period of approximately 28 months. Demolition, grading, and the construction of project infrastructure would be completed first, followed by building construction. The existing sensitive receivers include residences to the north, south, and east, about 80 feet from the project site. Noise sensitive uses to the west are located 250 feet and further from the site, across from the UPRR tracks. Hourly average noise levels would range from 77 to 84 dBA L_{eq} during the busiest construction periods at a distance of about 80 feet. As construction moves away from the perimeter of the site or indoors, noise levels experienced at noise sensitive receptors will be lower. Shielding by barriers or buildings would provide an additional 5 to 10 decibels of attenuation at distant receptors.

Noise sensitive uses located south of the site along East Taylor Street and east of the site along North 10th Street are exposed to existing noise levels of about 70 and 69 dBA DNL, respectfully. At these residences, daytime construction noise could exceed ambient noise levels by up to 15 dBA when activities are located nearest to receptors. At land uses to the west and north, which are exposed to ambient noise levels around 62 dBA DNL, daytime construction noise would exceed ambient noise levels by up to 22 dBA. This is a potentially significant impact.

Mitigation Measure N-2: Implement General Plan Policy EC-1.7 to reduce the impact to a less-than-significant level:

EC-1.7 Require construction operations within San Jose to use best available noise suppression devices and techniques and limit construction hours near residential uses per the City's Municipal Code.

The best available noise suppression devices and techniques shall include, but not be limited to, the following:

1. Limit project demolition and construction activities between 7:00 a.m. and 6:00 p.m., Monday through Friday, and 8:00 a.m. to 5:00 p.m. on Saturdays. No construction activities should occur Sundays or holidays. Soil extraction units, which are proposed to run 24/7 for a period of 6 weeks prior to construction, are excluded from this limitation because units are anticipated to generate worst case noise levels of less than 45 dBA at adjacent residences.

2. Construct units at the perimeter of the site as early as possible so that the completed buildings will provide acoustical shielding for existing adjacent residences. Constructing units along the northern, southern, and eastern perimeters of the site would provide approximately 10 dB of noise reduction during the remainder of project construction activities.

3. Utilize ‘quiet’ models of air compressors and other stationary noise sources where technology exists.

4. Equip all internal combustion engine-driven equipment with mufflers, which are in good condition and appropriate for the equipment.

5. Locate all stationary noise-generating equipment, such as air compressors and portable power generators, as far away as possible from businesses, residences or noise-sensitive land uses.

6. Prohibit all unnecessary idling of internal combustion engines.

7. Notify all adjacent businesses, residences, and noise-sensitive land uses of the construction schedule in writing.

8. A temporary noise control blanket barrier could be erected, if necessary, along building facades facing construction sites. This mitigation would only be necessary if conflicts occurred which were irresolvable by proper scheduling. Noise control blanket barriers can be rented and quickly erected.

9. Designate a disturbance coordinator, responsible for responding to complaints about construction noise. The name and telephone number of the disturbance coordinator shall be posted at the construction site and made available to businesses, residences or noise-sensitive land uses adjacent to the construction site.

10. Provide written schedule to adjacent land uses and nearby residences of “noisy” construction activities.

With the incorporation of these standards measures, the noise impact resulting from project construction would be considered less-than-significant.

Impact 4: **Railroad Vibration.** Vibration levels generated by railroad trains would not exceed 80 VdB at proposed vibration sensitive uses. **This is a less-than-significant impact.**

Railroad trains are a source of groundborne vibration when receivers are located close to the tracks. The San Jose General Plan requires that new development within 100 feet of rail lines to demonstrate that vibration levels not exceed the FTA guidelines. The FTA criterion for groundborne vibration impacts is 80 VdB for infrequent events (less than 30 events per day).

Residential land uses are proposed as close as 170 feet east of the UPRR railroad tracks. Project development is proposed outside of the 100 foot setback specified by the City of San Jose. Additionally, based on the measured vibration data, the nearest residential units would be exposed to vibration levels of about 63 to 71 VdB, assuming similar travel speeds throughout the corridor. Vibration levels are not anticipated to exceed the FTA vibration assessment criteria at the nearest residential units to the UPRR. This is a less-than-significant impact.

Mitigation Measures: None Required.

Impact 5: **Construction Vibration.** Construction-related vibration would not be excessive at nearby residential land uses. **This is a less-than-significant impact.**

The construction of the project may generate perceptible vibration when heavy equipment or impact tools (e.g. jackhammers, hoe rams, etc.) are used in areas adjacent to developed properties. Construction activities would include demolition of existing structures, excavation, grading, site preparation work, foundation work, and new building framing and finishing. The proposed project would not require pile driving, which can cause excessive vibration.

The City of San Jose requires that new development minimize vibration impacts to adjacent uses during demolition and construction activities. The City's General Plan Policy EC-2.3 establishes a vibration limit of 0.08 in/sec PPV for sensitive historic structures and 0.2 in/sec PPV for buildings of normal conventional construction. The California Department of Transportation recommends a vibration limit of 0.3 in/sec PPV for buildings that are found to be structurally sound and designed to modern engineering standards. The Continental Can warehouse building is a historic structure located directly north of the site. No other sensitive historic structures or buildings that are documented to be structurally weakened adjoin the project site. Therefore, groundborne vibration levels exceeding 0.08 in/sec PPV at the Continental Can warehouse and 0.2 in/sec PPV at all other structures would have the potential to result in a significant vibration impact.

Table 7 presents typical vibration levels that could be expected from construction equipment at a distance of 25 feet. Project construction activities, such as drilling, the use of jackhammers, rock drills and other high-power or vibratory tools, and rolling stock equipment (tracked vehicles, compactors, etc.) may generate substantial vibration in the immediate vicinity of the work area. Jackhammers typically generate vibration levels of 0.035 in/sec PPV, and drilling typically generates vibration levels of 0.09 in/sec PPV at a distance of 25 feet. Vibration levels would vary depending on soil conditions, construction methods, and equipment used.

TABLE 7 Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 ft. (in/sec)	Approximate L_v at 25 ft. (VdB)
Pile Driver (Impact)	upper range	1.158	112
	typical	0.644	104
Pile Driver (Sonic)	upper range	0.734	105
	typical	0.170	93
Clam shovel drop		0.202	94
Hydromill (slurry wall)	in soil	0.008	66
	in rock	0.017	75
Vibratory Roller		0.210	94
Hoe Ram		0.089	87
Large bulldozer		0.089	87
Caisson drilling		0.089	87
Loaded trucks		0.076	86
Jackhammer		0.035	79
Small bulldozer		0.003	58

Source: Transit Noise and Vibration Impact Assessment, United States Department of Transportation, Office of Planning and Environment, Federal Transit Administration, May 2006.

The adjacent residences to the north, south, and east of the project site range are located about 80 feet from the proposed buildings. At these distances, vibration levels would be expected to be less than 0.2 in/sec PPV, which is below the significance threshold. Residences located further from the site would experience lower construction vibration levels. Vibration generated by construction activities near the project's property line would at times be perceptible, however, would not be expected to result in "architectural" damage to these buildings. This is a less-than-significant impact.

Mitigation Measures: None required.

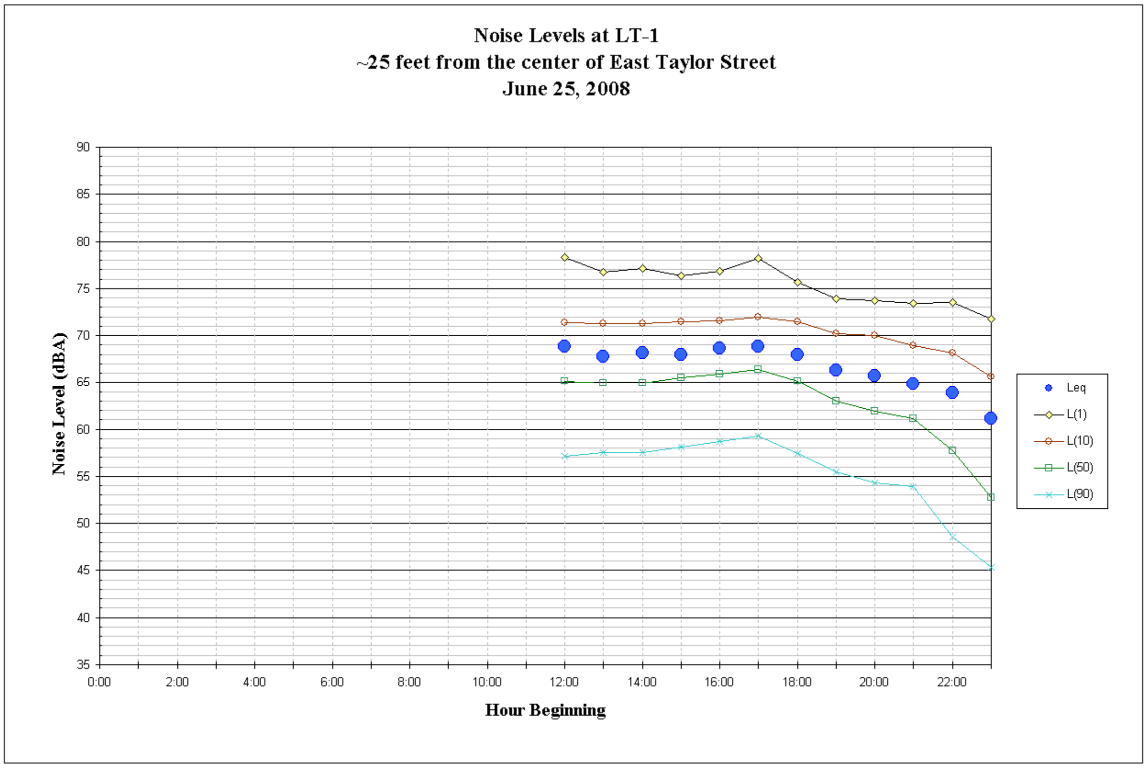
Impact 6: **Noise and Land Use Compatibility (Aircraft).** Residential uses developed at the project site would be located in a compatible noise environment with respect to noise generated by aircraft. **This is a less-than-significant impact.**

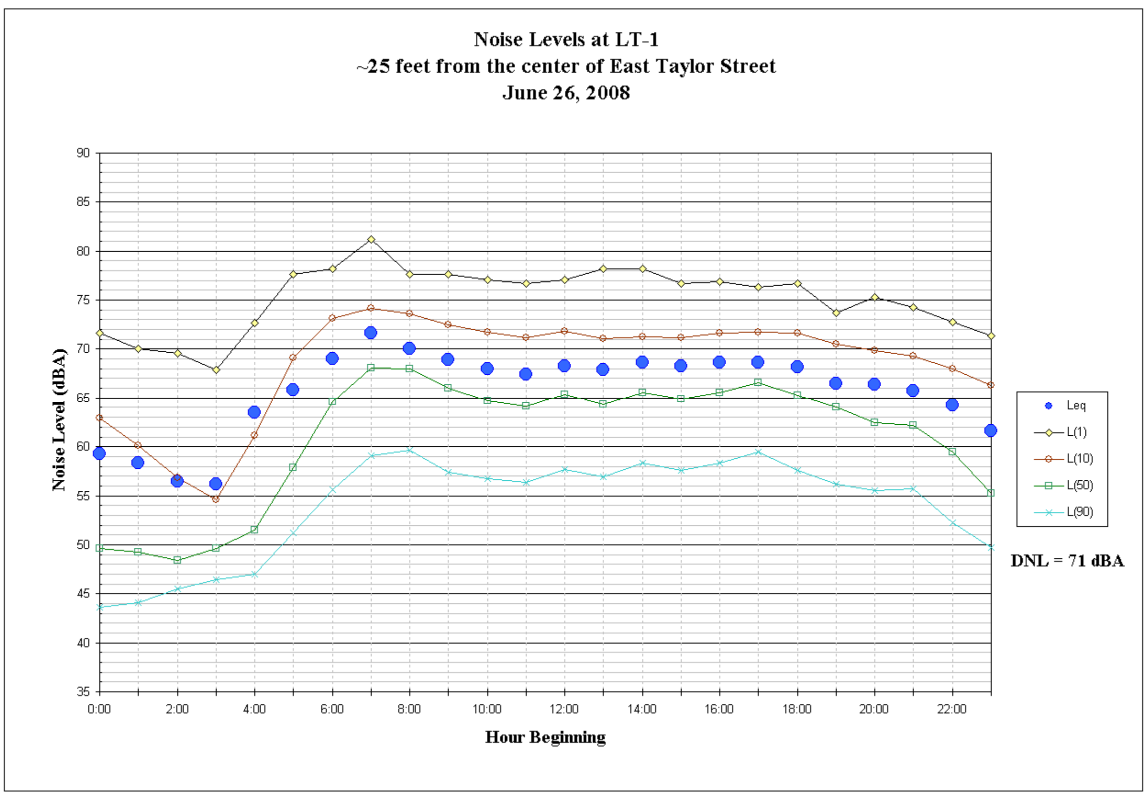
Aircraft operations associated with Mineta San Jose International Airport are audible at the project site as aircraft approach or depart the airport. A review of the 65 CNEL noise contour map established by the Santa Clara County ALUC indicates that the project site is located outside of the future Mineta San Jose International Airport 65 CNEL noise contour. Residential land uses proposed in exterior noise environments of 65 CNEL or less are considered compatible with aircraft noise by the Santa Clara County ALUC. Mitigation Measure N-1 will ensure interior noise levels from aircraft are 45 dBA DNL or less.

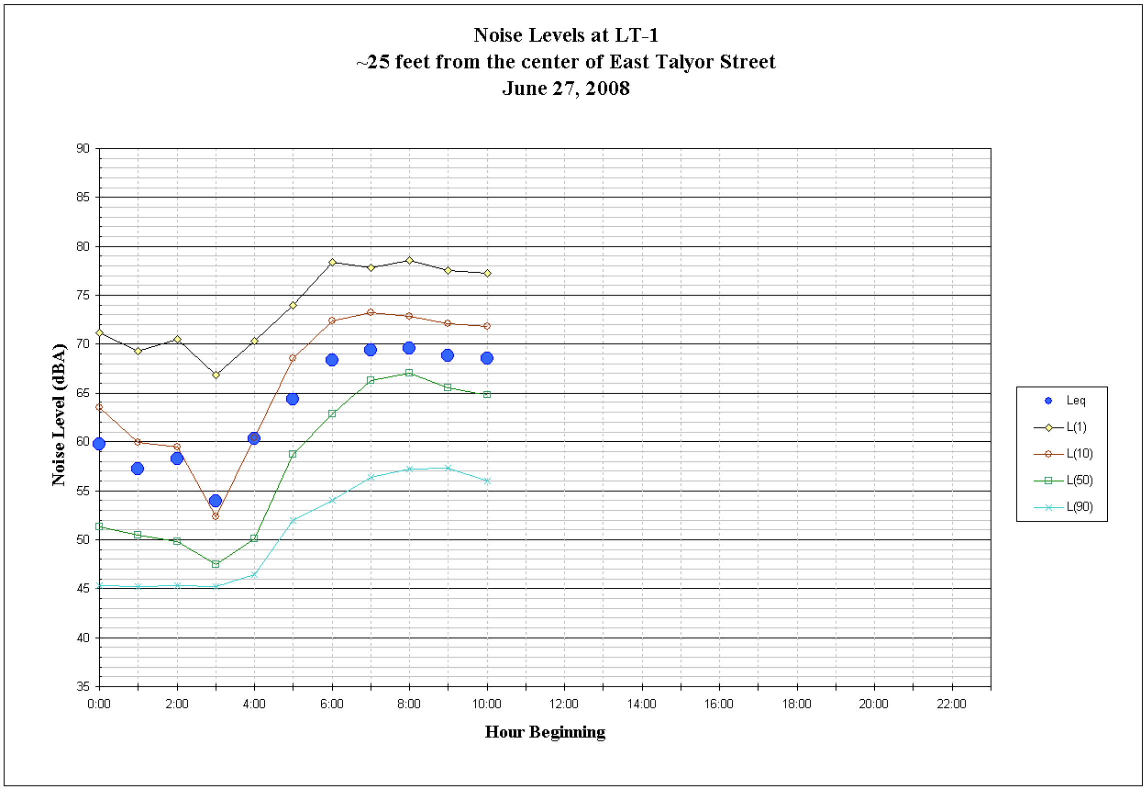
Mitigation Measures: None Required.

Appendix A: Noise and Vibration Measurement Locations

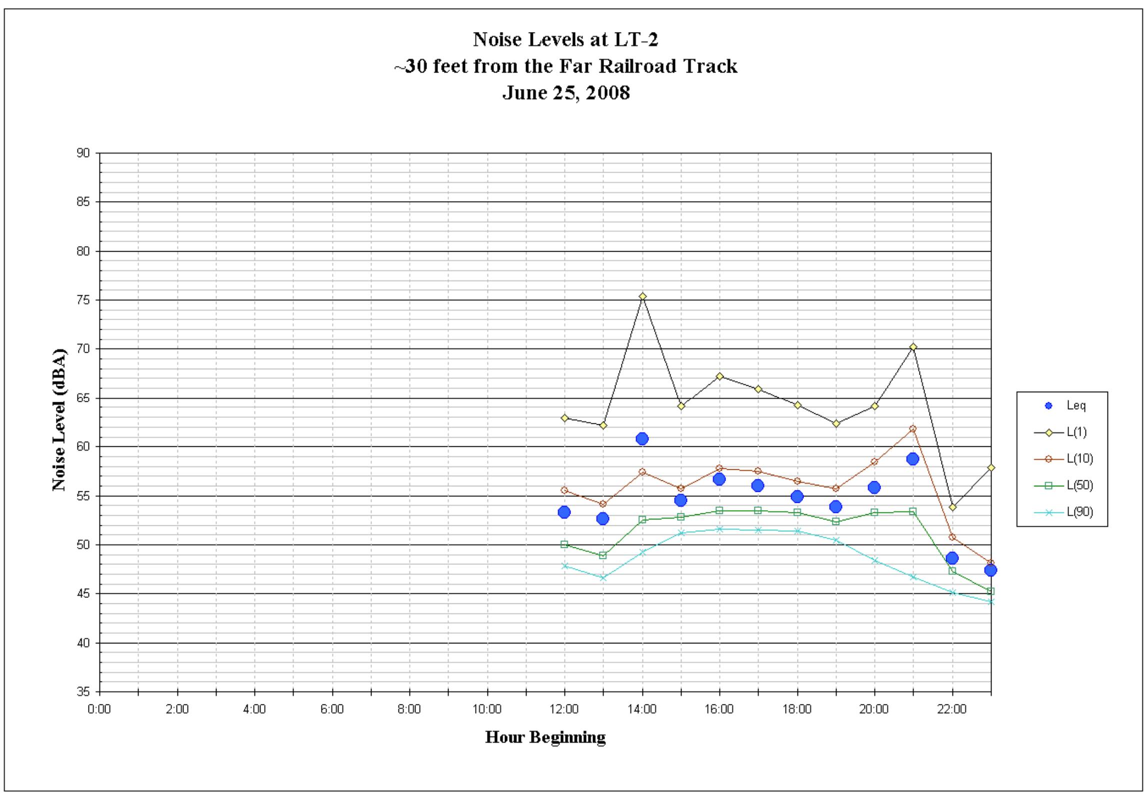
Appendix B: Daily Trend in Noise Levels



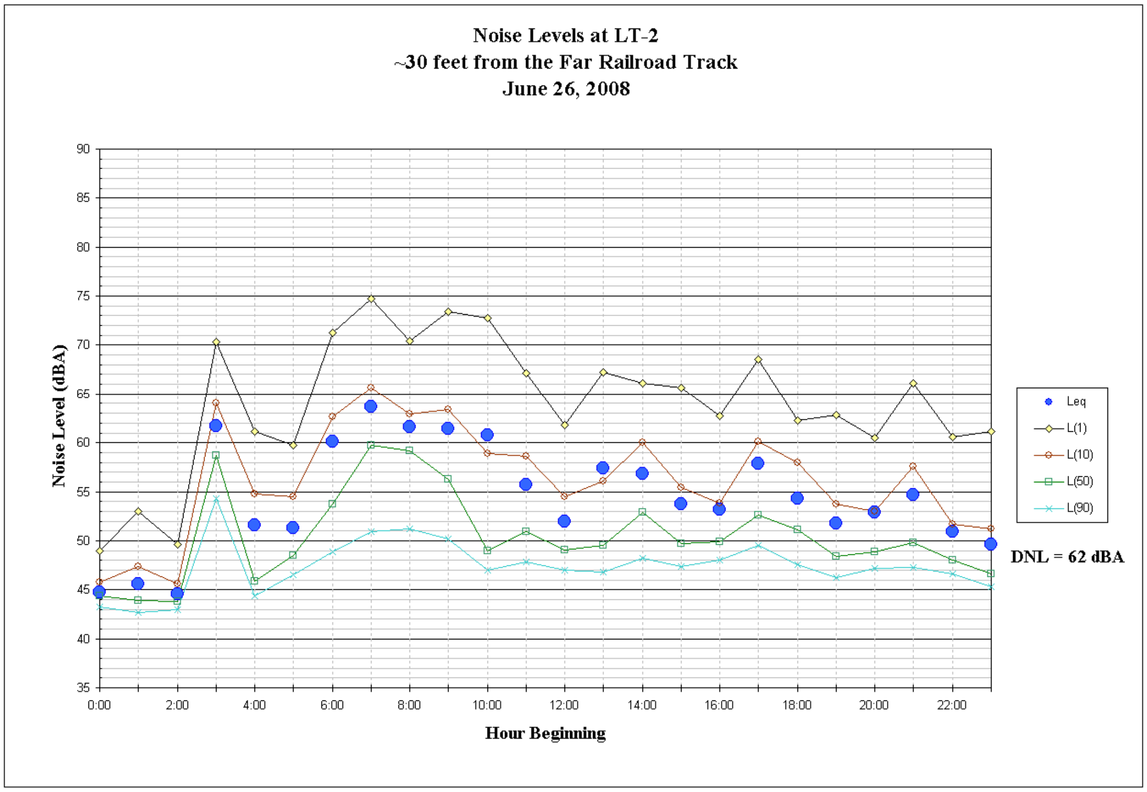


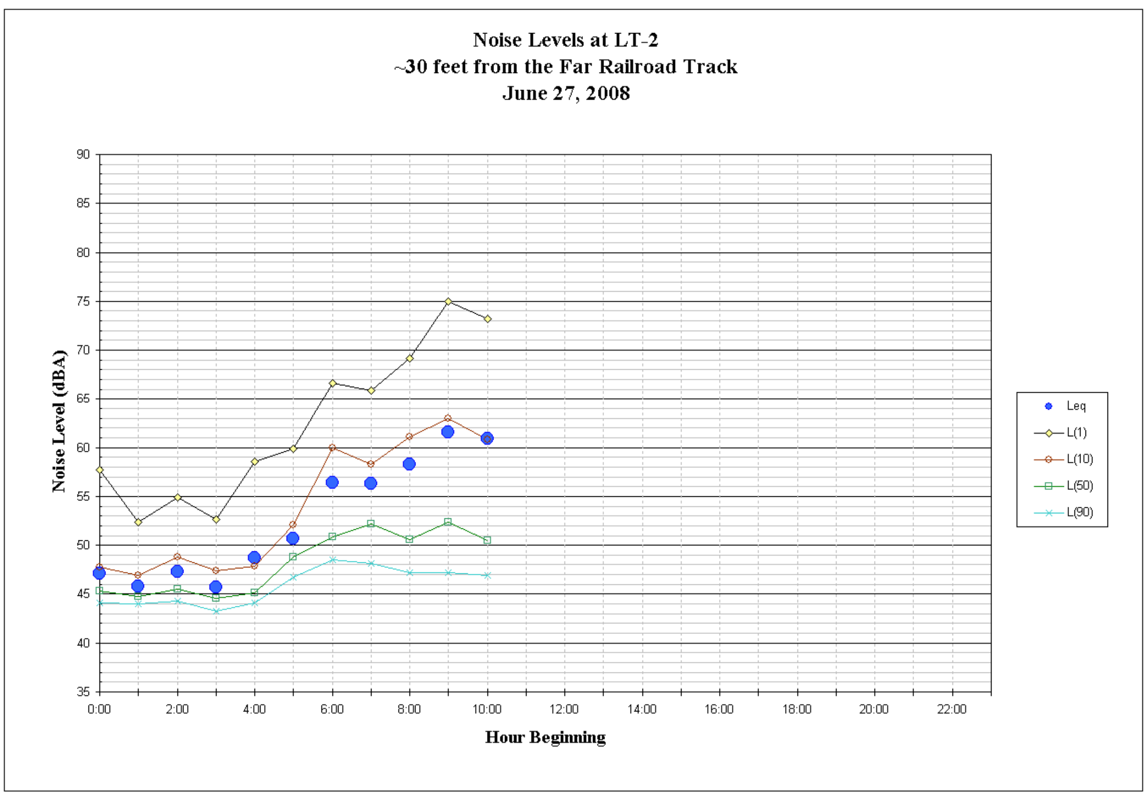


Noise Levels at LT-1
~25 feet from the center of East Talyor Street
June 27, 2008
Noise Level (dBA)
Hour Beginning
Leq
L(1)
L(10)
L(50)
L(90)

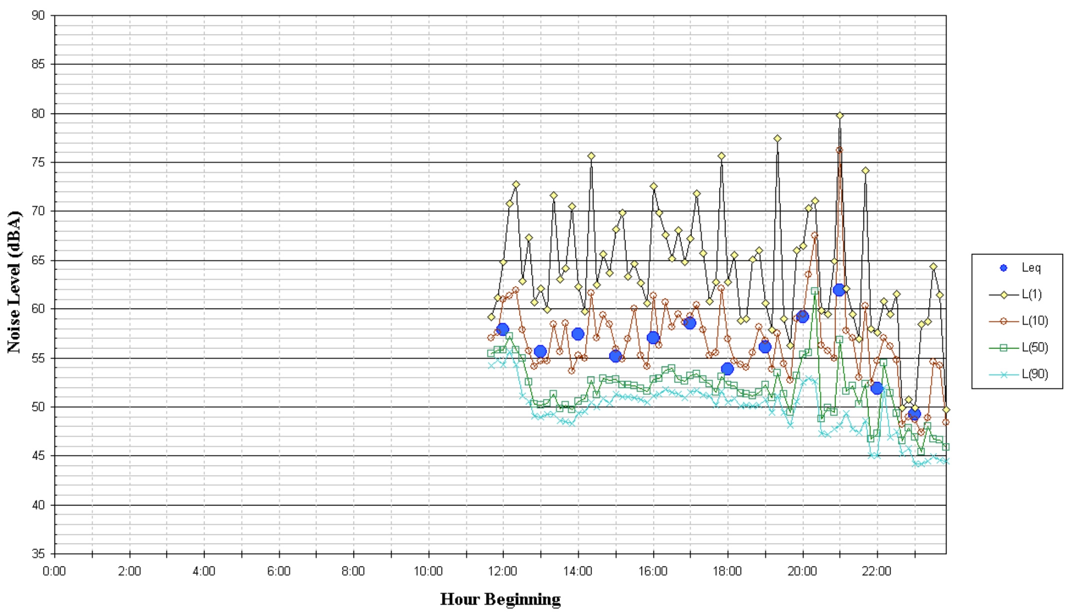


Noise Levels at LT-2
~30 feet from the Far Railroad Track
June 25, 2008
Noise Level (dBA)
Hour Beginning
Leq
L(1)
L(10)
L(50)
L(90)

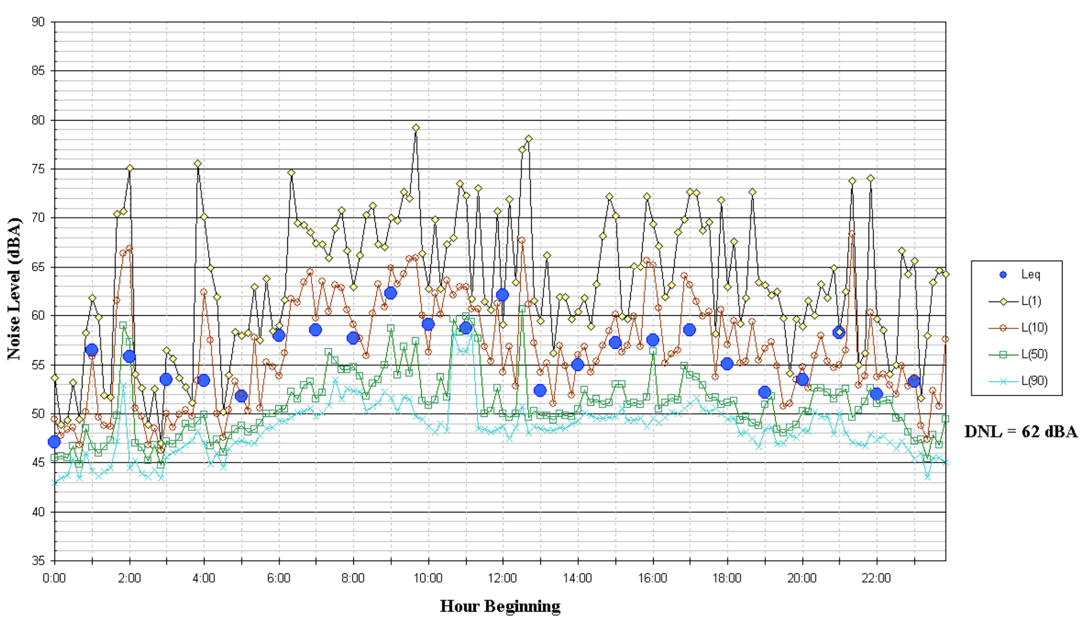

Noise Levels at LT-2
~30 feet from the Far Railroad Track
June 26, 2008
Noise Level (dBA)
Hour Beginning
Leq
L(1)
L(10)
L(50)
L(90)
DNL = 62 dBA

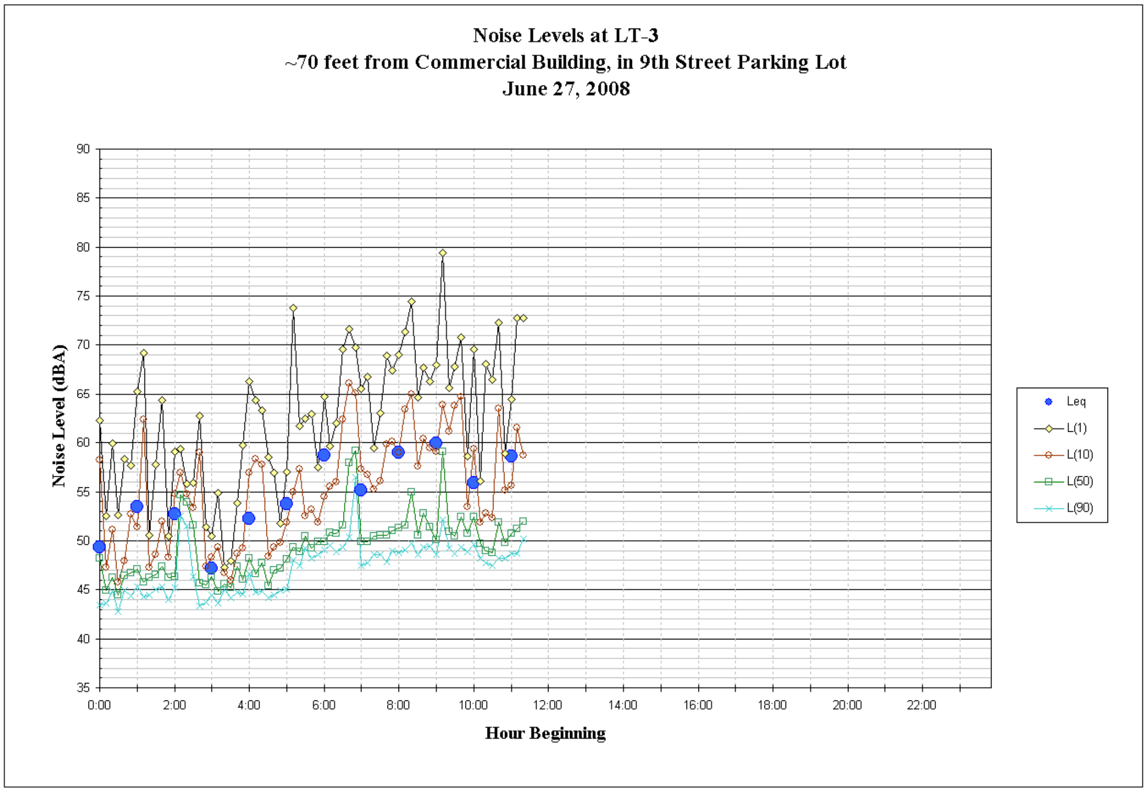

Noise Levels at LT-2
~30 feet from the Far Railroad Track
June 27, 2008
Noise Level (dBA)
Hour Beginning
Leq
L(1)
L(10)
L(50)
L(90)

Noise Levels at LT-3
~70 feet from Commercial Building, in 9th Street Parking Lot
June 25, 2008



Noise Levels at LT-3
~70 feet from Commercial Building, in 9th Street Parking Lot
June 26, 2008





Noise Levels at LT-3
~70 feet from Commercial Building, in 9th Street Parking Lot
June 27, 2008
Noise Level (dBA)
90
85
80
75
70
65
60
55
50
45
40
35
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Leq
L(1)
L(10)
L(50)
L(90)